

APPENDIX A - Inspection and Monitoring Plan

Inspection and Monitoring Plan Current Wastewater Pond Embankments

US Magnesium LLC

March 15, 2017

Revised December 6, 2017

1.0 PURPOSE

This Inspection and Monitoring Plan (IMP) provides a detailed description of the methods and procedures for performing and documenting the routine inspections as well as reporting requirements in the event that a release is identified. This IMP was prepared as specified in US Magnesium's (USM) December 21, 2016 response to the Utah Department of Environmental Quality, Division of Water Quality (DWQ) Warning Letter of Violation received by USM on November 21, 2016.

This November 2017 revision to the IMP incorporates the contingency/interim measures USM completed in 2017 to prevent or minimize the potential for discharge of process wastewater to the surface of the area to the northwest of the Current Wastewater Pond (CWP) and to the section of the Skull Valley Diversion Ditch (SVDD) adjacent to the south side of the CWP that USM has permanently ceased using. The additional features that have been added to this IMP are:

1. The north embankment of the CWP;
2. The DWQ-permitted overflow pipe from the CWP to the old waste pond (OWP); and
3. The OWP embankment.

USM added these features to its inspection log form and routine inspections beginning the week of November 6, 2017.

2.0 INSPECTION FREQUENCY

Inspections will be performed daily Monday through Friday during periods when the pond water level is in direct contact with the CWP embankments (or OWP embankment for the OWP embankment inspections). During months when the water level retreats and is not in contact with the CMP and/or OWP embankments, the inspections will be performed weekly.

3.0 INSPECTION PROCEDURES

The inspections will be performed by qualified US Magnesium personnel, typically the Environmental Manager, Environmental Coordinator or their designee.

The inspections of the CWP embankments will encompass Inspection Areas 1 through 3, the overflow pipe, and the north embankment as shown on Figure 1. Each inspection will be performed beginning from the southwest corner of Inspection Area 1 and progressing

counterclockwise to the southwest corner of the north embankment of the CWP. The overflow pipe will be inspected at its location within Inspection Area 2. USM has repaired and fortified the CWP north embankment to minimize the potential for wastewater to flow and impound against the northwest embankment (Inspection Area 4). The northwest embankment will now function only as secondary containment; therefore, inspection of the Inspection Area 4 will focus on maintaining its integrity in the event there is a wastewater release through the north embankment that reaches the northwest embankment. The OWP inspection will proceed across its embankment from the west end to the southeast corner as shown on Figure 1. The inspector will drive at an appropriately slow speed to be able to safely observe the condition of the embankments while driving. Areas of the embankments identified during the driving inspection that are potentially problematic will also be inspected on foot. The overflow pipe inlet and outlet will be inspected on foot. The inspector will be looking for the following indicators of damage to or loss of the integrity of the CWP and OWP embankments:

- Seepage from or piping through the outside of the embankment
- Subsidence/sinkholes in the top/side slopes of the embankments
- Undercutting on the inside of the embankments
- Animal burrows on the top/side slopes of the embankments

For Inspection Area 1, the inspection will include observation of the condition of the earthen containment berms in the section of the SVDD adjacent to the south side of the CWP.

If seepage from or piping through the outside of the embankment or other damage that could impair the integrity of the embankment is observed, then maintenance will be performed up to and including implementation of the contingency plan.

The inspector will be looking for the following indicators of damage to or impairment of the function of the overflow pipe:

- Blockage (debris/sediment) restricting flow
- Loss of riprap and/or evidence of erosion affecting the integrity of the pipe inlet and outlet

If blockage or erosion loss that could impair the function of the overflow pipe is observed, then maintenance will be performed (e.g., clearing debris, adding riprap).

4.0 DOCUMENTATION AND REPORTING

The inspections will be documented on a field form. An example form is attached to this IMP.

USM will report any releases resulting from loss of containment through the north embankment that reach the northwest embankment and/or any loss of containment through the OWP embankment, not releases to groundwater from pond operations. US Magnesium will provide verbal notification via telephone to DWQ on the same day that any such release is identified during the inspections. The notification will include a description of the release and a schedule for maintenance and repairs to the area of the embankment to stop the release.

5.0 MAINTENANCE

If seepage from or piping through the Inspection Area 1 (adjacent to the SVDD), outside of the north and/or OWP embankments is observed, the area will be repaired on a priority basis. The repairs will typically involve excavation down to the seep on the outside of the embankment and replacement with compacted clayey soil. Then the inside portion of the embankment will be excavated and replaced with compacted clayey soil. After the initial repairs, the area will be evaluated consistent with the Contingency Plan which is contained in Appendix A to this IMP.

If damage that could impair the integrity of the embankment (e.g., undercutting, sinkholes, burrows) is observed during an inspection, then maintenance will be performed. The maintenance will generally involve adding soil to reinforce the embankment or fill the burrows/sinkholes.

Wastewater Pond Embankment and Overflow Pipe Inspection Field Form

Date:	Time:	Inspector (initials):	
Weather/Ground Conditions:			
Inspection Area	Inspection Item	None Observed	Yes (Enter Comment Below)
1	Seepage from or piping through the outside of the embankment		
	Subsidence/sinkholes in the top/side slopes of the embankments		
	Excessive undercutting on the inside of the embankments		
	Animal burrows on the top/side slopes of the embankments		
	Breaches or seepage through the containment berms in the SVDD		
2	Seepage from or piping through the outside of the embankment		
	Subsidence/sinkholes in the top/side slopes of the embankments		
	Excessive undercutting on the inside of the embankments		
	Animal burrows on the top/side slopes of the embankments		
3	Seepage from or piping through the outside of the embankment		
	Subsidence/sinkholes in the top/side slopes of the embankments		
	Excessive undercutting on the inside of the embankments		
	Animal burrows on the top/side slopes of the embankments		
Overflow Pipe	Blockage (debris/sediment) restricting flow		
	Loss of riprap and/or evidence of erosion affecting the integrity of the pipe inlet and outlets		
North Embankment	Seepage from or piping through the outside of the embankment		
	Subsidence/sinkholes in the top/side slopes of the embankments		
	Excessive undercutting on the inside of the embankments		
	Animal burrows on the top/side slopes of the embankments		

4	Wastewater in contact with embankment		
(Northwest Embankment)	Erosion or animal burrows on the top/side slopes of the embankments that could affect the integrity as a secondary containment embankment		
Old Pond Embankment	Seepage from or piping through the outside of the embankment		
	Subsidence/sinkholes in the top/side slopes of the embankments		
	Excessive undercutting on the inside of the embankments		
	Animal burrows on the top/side slopes of the embankments		
<p>Comment (for any unacceptable condition[s]):</p> <hr/> <hr/> <hr/> <hr/>			

APPENDIX A

Contingency Plan

March 15, 2017
Revised December 6, 2017

This Contingency Plan documents potential scenarios for loss of containment from the Current Wastewater Pond (CWP), including when increased monitoring frequency and possible corrective action (such as construction of a containment berm) are required. Consistent with the November 2017 revision to the IMP, the Contingency Plan has been revised to actualize the contingency/interim measures USM completed in 2017 to prevent or minimize the potential for discharge of process wastewater to the surface of the area to the northwest of the Current Wastewater Pond (CWP) and to the section of the Skull Valley Diversion Ditch (SVDD) adjacent to the south side of the CWP that USM has permanently ceased using.

The most likely scenario for loss of containment from the CWP would be a result of the low-pH wastewater dissolving carbonate-rich clays and possibly oolitic sands beneath the pond and carbonate-rich clays within the embankments which creates a channel (or “pipe”) through the side or base of the embankment. The occurrence of dissolution piping is consistent with the loss of containment observed and described in the MWH/Stantec Technical Memorandum – Current Waste Pond Embankments Visual Inspection and Recommended Interim Measures, February 1, 2017 (Technical Memorandum). Another scenario for loss of containment from the CWP would be the pond water level exceeding the elevation of the low points of the embankment resulting in pond water overtopping the embankment. There is a low probability that the embankments would fail due to animal burrowing and maintenance will address burrowing identified during the inspections.

Specific interim actions to prevent potential pond water piping through and/or overtopping the embankment were identified in US Magnesium’s (USM) December 26, 2016 letter, and are mentioned below for each Inspection Area. Specific contingency measures for each Inspection Area are described below.

Inspection Area 1

As an interim action to prevent any release from the CWP migrating to the Great Salt Lake, USM previously constructed four containment berms in the Skull Valley Diversion Ditch (SVDD). Pursuant to the Division of Water Quality (DWQ) April 27, 2017 Construction Permit for the Planned Contingency Measures for the CWP and a DWQ/USM meeting and site visit on November 15, 2017, USM will reinforce the berm on the upgradient side of culvert 4 with engineered and compacted fill. The location of that berm is shown on Figure 1. The other three berms upgradient from the reinforced culvert 4 berm will remain.

The DWQ April 27, 2017 Construction Permit for the Planned Contingency Measures for the CWP included a contingency measure for construction of a fifth containment berm east and

downgradient of culvert 4 and an overflow spillway cut into the berm to divert water impounded behind the berm to flow into the old waste pond (OWP; PRI 7). As discussed during the November 15, 2017 DWQ/USM site meeting, USM anticipates that the overflow pipe from the CWP to the OWP and the addition of the engineered berm at culvert 4 prevents the potential for wastewater to flow into the SVDD below culvert 4. Thus, USM is not currently planning to construct the fifth berm and spillway but will retain it as a contingency measure. The location of the contingent containment berm and spillway are shown on Figure 1.

Inspection Areas 2 and 3

Pursuant to the DWQ April 27, 2017 Construction Permit for the Planned Contingency Measures for the CWP and October 5, 2017 DWQ approval of the minor changes to the Construction Permit and Engineering Drawing, US Magnesium (USM) installed the overflow pipe from the CWP to the OWP on November 4, 2017 and completed construction on November 6, 2017. The location of the overflow pipe is shown on Figure 1.

North Embankment

The overflow pipe described for Inspection Areas 2 and 3 will function as a contingency measure for the north embankment due to the hydraulic interconnection within the Current Wastewater Pond at the current relatively high water level. In addition, USM has repaired and fortified the CWP north embankment to minimize the potential for wastewater to flow and impound against the northwest embankment. During August through December 2017, USM hauled, placed, graded and compacted over 10,000 cubic yards of borrow soil to widen the north berm, all within the existing alignment and extent of the north embankment. The north embankment was widened to a top width of about 50 feet (about 3 times wider).

As an additional contingency, USM would construct a new dike at the narrows between the current waste pond northeast embankment and the gypsum pile. The new dike would largely cut off hydraulic connectivity between the southeastern and northwestern portions of the CWP and prevent low pH wastewater flow to the north embankment. Gypsum slurry water will continue to impound in the area north of the new dike but this water has a pH in the range of 3 to 6 and consists of calcium sulfate, calcium chloride and residual calcium carbonate. The pH and composition of the gypsum slurry water will minimize potential for reaction (dissolution) of the calcium carbonate oolitic sands underlying the north embankment and thus minimize the potential for piping under the embankment. Because the new separation dike would be temporary and not intended for traffic loads, USM would not intend that the dike be an engineered feature. On-site borrow material would be placed to fill the channel from the bottom first and then built up to a height 3-feet above the current water level of approximately 4,215 feet. Over the winter of 2017 to 2018, USM will evaluate the need for this contingency measure based on the performance of the north embankment pursuant to the IMP specified inspections and maintenance.